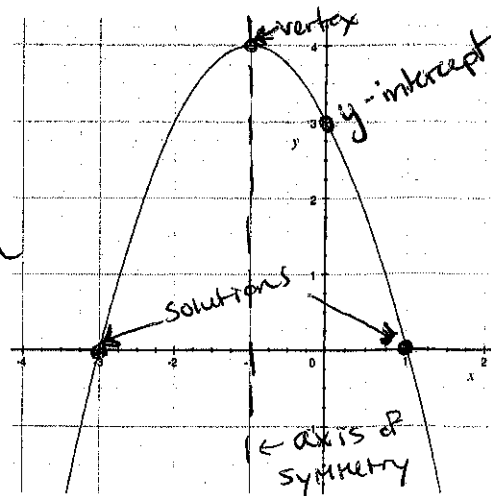


REVIEW - QUADRATIC FUNCTIONS

KEY

BASIC CONCEPT QUESTIONS

- Name and write the equation of the two forms we use to represent quadratic functions.
Standard Form: $y = ax^2 + bx + c$ Vertex Form: $y = a(x-h)^2 + k$
- Circle all of the following functions that are quadratic functions.
 $y = -\frac{1}{2}x + 3$ $y = 8x^2 - 7$ $y = x^2$ $y = 9x^3 - 5x^2 + 2$ $y = -6(x+1)^2$
- Given an equation, how do you know if a parabola is concave up or concave down?
If a is positive \rightarrow concave up a negative \rightarrow concave down
- Given an equation, how do you know if the parabola will be skinnier or wider than the parent function?
 $|a| > 1 \rightarrow$ skinnier $|a| < 1 \rightarrow$ wider \ast negatives don't matter! Use absolute value!
- What do c and k change about the graph?
Shift up + down (vertical translation)
- What does the h value change about the graph?
Shift left and right (horizontal translation) \ast opposite sign as what you see in $()$ left + right -
- What is the vertex?
Max or min value, turning point. Always on axis of symmetry.
- How do you find the vertex of a quadratic function?
 - From Standard Form?
 $x = -\frac{b}{2a}$ plug back in
 - From Vertex Form?
 (h, k)
- From the equation, how can you tell if the vertex will be a maximum or a minimum?
 $a > 0 \rightarrow$ min $a < 0 \rightarrow$ max
- What is the axis of symmetry? $x =$
Line through vertex down middle of parabola (that cuts it into 2 symmetric halves)
- How do you find the axis of symmetry? $-x$ value of vertex
 - From Standard Form?
 $x = -\frac{b}{2a}$
 - From Vertex Form?
 $x = h$
- How do you find the y -intercept of any function?
plug in $x = 0$
- List all the other names for "solutions" of a quadratic function.
roots, zeros, x -intercepts
- What do you need to be sure is true about your function before you start finding solutions?
that it $= 0$
- What are the 3 methods for finding solutions of a quadratic function?
① Graphing (+ find x -intercepts) ② Factoring + zero product property ③ Quadratic Formula
- State the quadratic formula.
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- What is the discriminant? $b^2 - 4ac$
- What does the value of the discriminant tell you about your function if it is
 - positive $\sqrt{\quad}$ 2 real solutions
 - negative $\sqrt{\quad}$ 2 complex solutions
 - zero $\sqrt{\quad}$ 1 real solution
- Label all of the key features (vertex, axis of symmetry, solutions, y -intercept) on the graph to the right.
- Give either definition for i .
 $i = \sqrt{-1}$ $i^2 = -1$



PRACTICE PROBLEMS

21. Consider the function $y = 4x^2 - 24x - 7$

A. Find the y-intercept $(0, -7)$

B. Will the vertex be a maximum or a minimum? Why? min b/c a is positive

C. Find the vertex. $x = \frac{-b}{2a} = \frac{24}{2(4)} = 3$ $4(3)^2 - 24(3) - 7 = -43$ $(3, -43)$

22. Sketch the graph of a quadratic function that has

a. exactly one positive solution

b. exactly two solutions, one positive and one negative

c. no real solutions

23. Find the solutions of $6x^2 = 150$

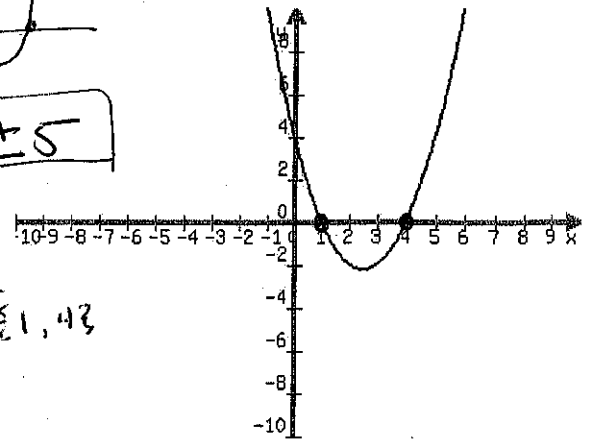
$$\sqrt{x^2} = \sqrt{25}$$

$$x = \pm 5$$

24. State the solution(s) of the quadratic function based on the graph to the right.

$$x = 1, 4$$

Solution set $\{1, 4\}$



25. Find the solutions of $9x^2 = 4x$ by factoring. SHOW ALL WORK.

$$9x^2 - 4x = 0$$

$$x(9x - 4) = 0$$

$$x = 0$$

$$9x - 4 = 0$$

$$9x = 4$$

$$x = \frac{4}{9}$$

26. Find the solutions of $y = x^2 - 6x - 7$ by factoring. SHOW ALL WORK.

$$(x - 7)(x + 1) = 0$$

$$x - 7 = 0$$

$$x + 1 = 0$$

$$x = 7 \quad x = -1$$

27. Find the solutions of $y = -2x^2 + 6x + 5$ using the quadratic formula. SHOW WORK.

$$a = -2 \quad b = 6 \quad c = 5$$

$$b^2 - 4ac = 6^2 - 4(-2)(5) = 76$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{76}}{-4}$$

$$\approx -0.8$$

$$\approx 3.68$$

28. Find the solutions of $f(x) = 3x^2 + 2x + 7$ using the quadratic formula. SHOW WORK.

$$a = 3 \quad b = 2 \quad c = 7$$

$$b^2 - 4ac = 2^2 - 4(3)(7) = -80$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2 \pm \sqrt{-80}}{6}$$

$$= \frac{-2 \pm i\sqrt{80}}{6}$$

29. Find the solutions of $x^2 + 7x = -10$ using the method of your choice. SHOW WORK.

$$x^2 + 7x + 10 = 0$$

$$+10 \quad +10$$

$$(x + 5)(x + 2) = 0$$

$$x + 5 = 0$$

$$x + 2 = 0$$

$$x = -5, -2$$

30. Find the solutions of $y = 5x^2 + 7x + 2$ using the method of your choice. SHOW ALL WORK.

$$x = (-1, 0)$$

$$Q.F.$$

$$b^2 - 4ac = 7^2 - 4(5)(2) = 9$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-7 \pm \sqrt{9}}{10} = \frac{-7 \pm 3}{10}$$

$$x = (-1, 0)$$

31. Write the equation of the quadratic function whose vertex is $(-4, 5)$ through the point $(-2, 20)$.

$$20 = a(-2 - (-4))^2 + 5$$

$$a = \frac{15}{36} = \frac{5}{12} \approx .417$$

$$y = \frac{5}{12}(x + 4)^2 + 5$$

32. Write the equation of the quadratic function whose solutions/roots are -4 and 5 .

$$x = -4$$

$$x + 4 = 0$$

$$(x + 4)(x - 5) =$$

$$x^2 - x - 20$$

33. Write the equation of a quadratic function that is concave up, skinnier than the parent function, and whose vertex is at $(2, 12)$

$$y = 3(x - 2)^2 + 12$$

34. Write the equation of a quadratic function that is concave down, wider than the parent function and is shifted down 5 units.

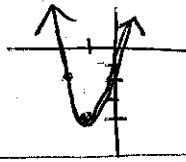
$$y = -\frac{1}{2}x^2 - 5$$

$$|a| < 1$$

35. Consider the function $f(x) = 2(x-5)^2 + 3$. Write the equation of a new function, $g(x)$, that takes $f(x)$ and shifts it 4 units left and 9 units down. $g(x) = 2(x-1)^2 - 6$

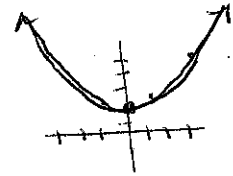
36. Graph the function $y = 3(x+1)^2 - 4$.

$(h, k) = (-1, -4)$



37. Graph the function $y = \frac{1}{3}x^2 + 2$.

$(0, 2)$



38. An object in the air is given by the equation $h(t) = -16t^2 + 4t + 8$.

- a. Find the time when the object reaches its maximum height. $t = \frac{-b}{2a} = \frac{-4}{2(-16)} = 0.125 \text{ sec}$
 b. Find the maximum height of the object. $h(0.125) = -16(0.125)^2 + 4(0.125) + 8 = -0.25 + 0.5 + 8 = 8.25 \text{ ft}$
 c. How high is the object after 3 seconds in the air?
 d. When will the object hit the ground? $h(3) = -124 \rightarrow \text{already landed!} \rightarrow 0$

Solutions

39. If $f(x) = x^2$, find and simplify $f(3i) = (3i)^2 = 9i^2 = 9(-1) = -9$

40. Simplify $(3+7i) - (9+4i) = -6 + 3i$

41. Simplify $(3+7i)(9+4i) = 27 + 12i + 63i + 28i^2 = 27 + 75i - 28 = -1 + 75i$

42. Simplify $\sqrt{-36} = 6i$

43. Solve $x^2 = -81$. (Make sure you find BOTH solutions, not just one)

$x = \pm 9i$

44. What is the value of x in the equation $\sqrt{x+4} = 2i$?

$\sqrt{x+4} = 2i$

$x+4 = (2i)^2 = 4i^2 = -4$

$x+4 = -4$

$x = -8$

45. What is the greatest common factor of $24a^3b^2c$ and $10ab^2c^3$?

$2ab^2c$

46. If $5x$ is one factor of $10x^2 - 15x$, what is the other factor? $5x(2x-3)$

47. Factor $x^2 - 81$. $(x-9)(x+9)$

48. Factor $3x^2 - 12$ completely. $3(x^2 - 4) = 3(x-2)(x+2)$

49. What is a common factor of $x^2 + 3x - 10$ and $x^2 + 6x + 5$?

$(x+5)(x-2)$

$(x+5)(x+1)$

$x+5$

50. Given the table, find the equation of the quadratic function.

$y = (x-3)^2$

x	y
1	4
2	1
3	0
4	1
5	4

vertex

$a = 1$